



Armed Forces College of Medicine AFCM



Diaphragm and intercostal muscles

INTENDED LEARNING OBJECTIVES (ILO)



By the end of this section each of the student should be able to:

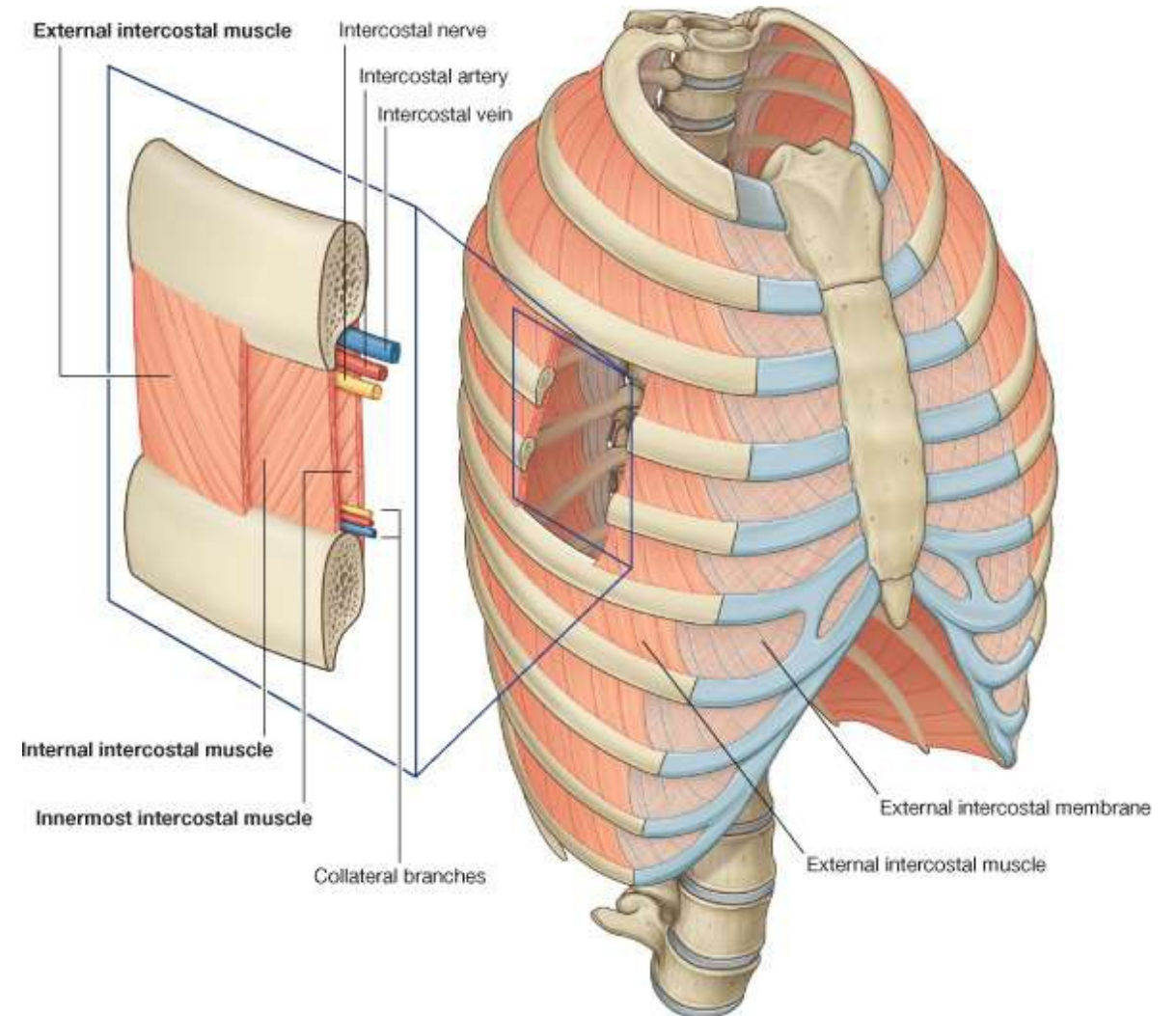
1. Identify the attachments of chest wall muscles (external, internal intercostals and transversus thoracis).
2. Identify the chest wall muscles.
3. Identify the course of the intercostal nerves and vessels.
4. Identify the attachment of diaphragm and site of major openings.

Chest wall muscles



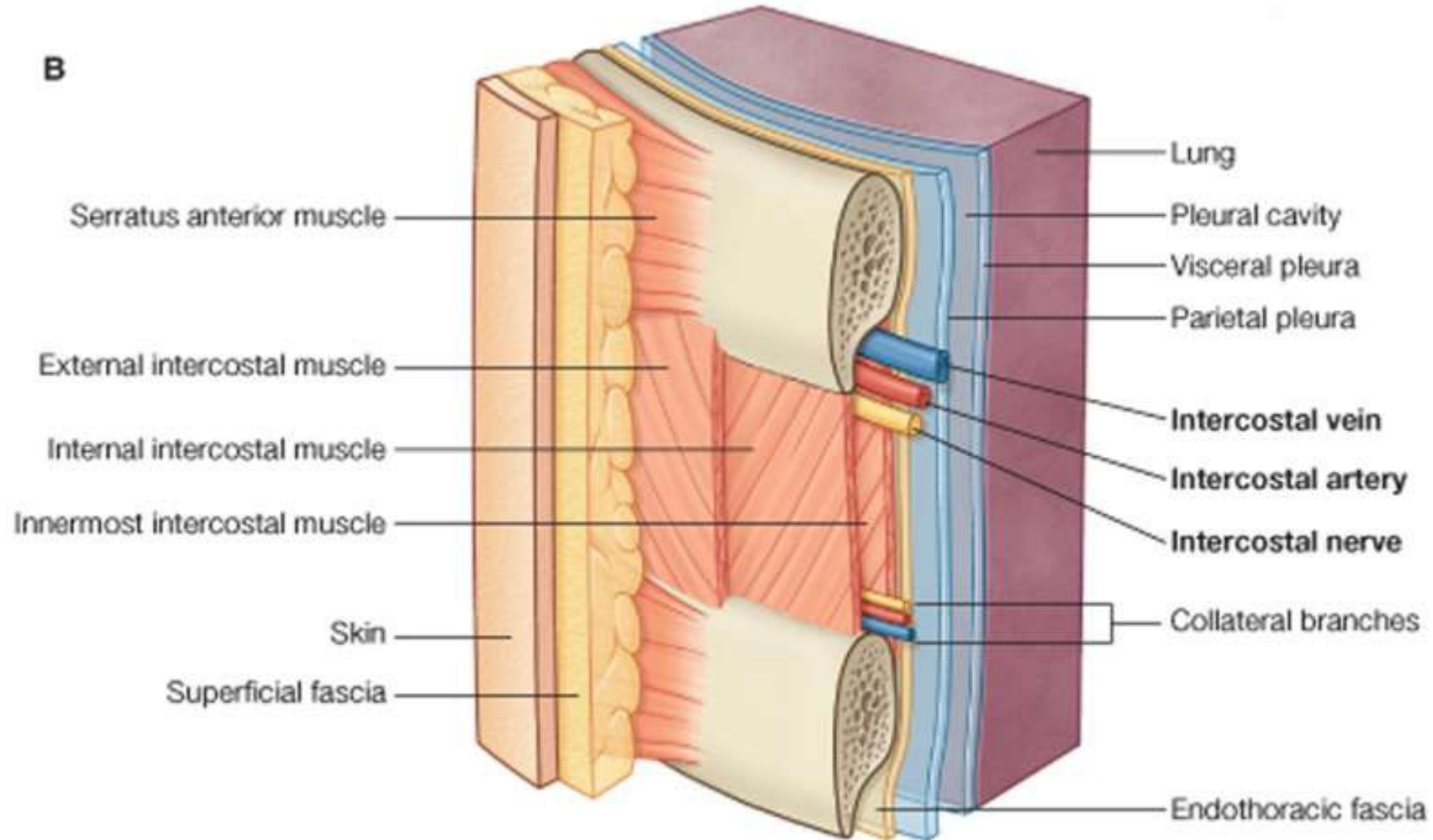
Muscles of thoracic wall:

External intercostal
Internal intercostal
Innermost intercostal
Subcostalis muscle
Sternocostalis muscle



Gray's anatomy for students

Chest wall muscles



Gray's anatomy for students

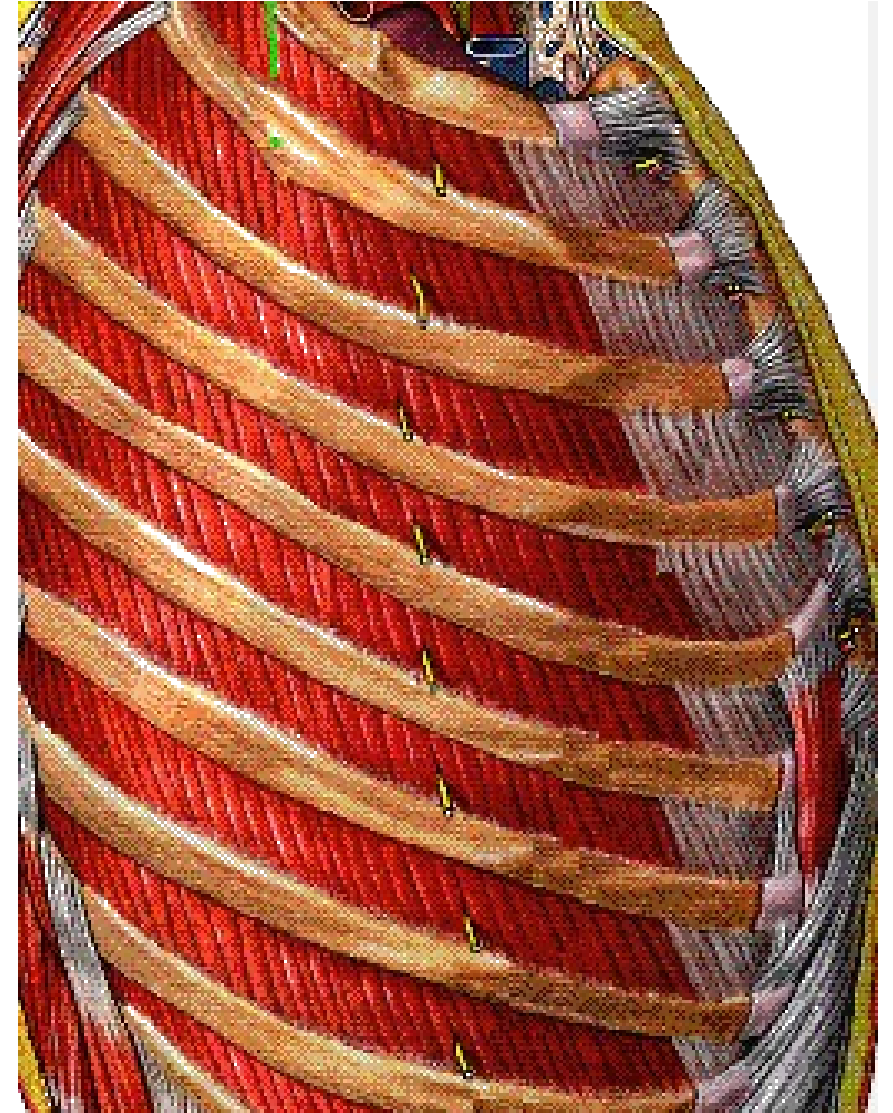
External intercostal muscle



Origin: from the lower border of a rib above.

Insertion: Its fibers extend obliquely downwards and forwards to be inserted into the upper border of the rib below.

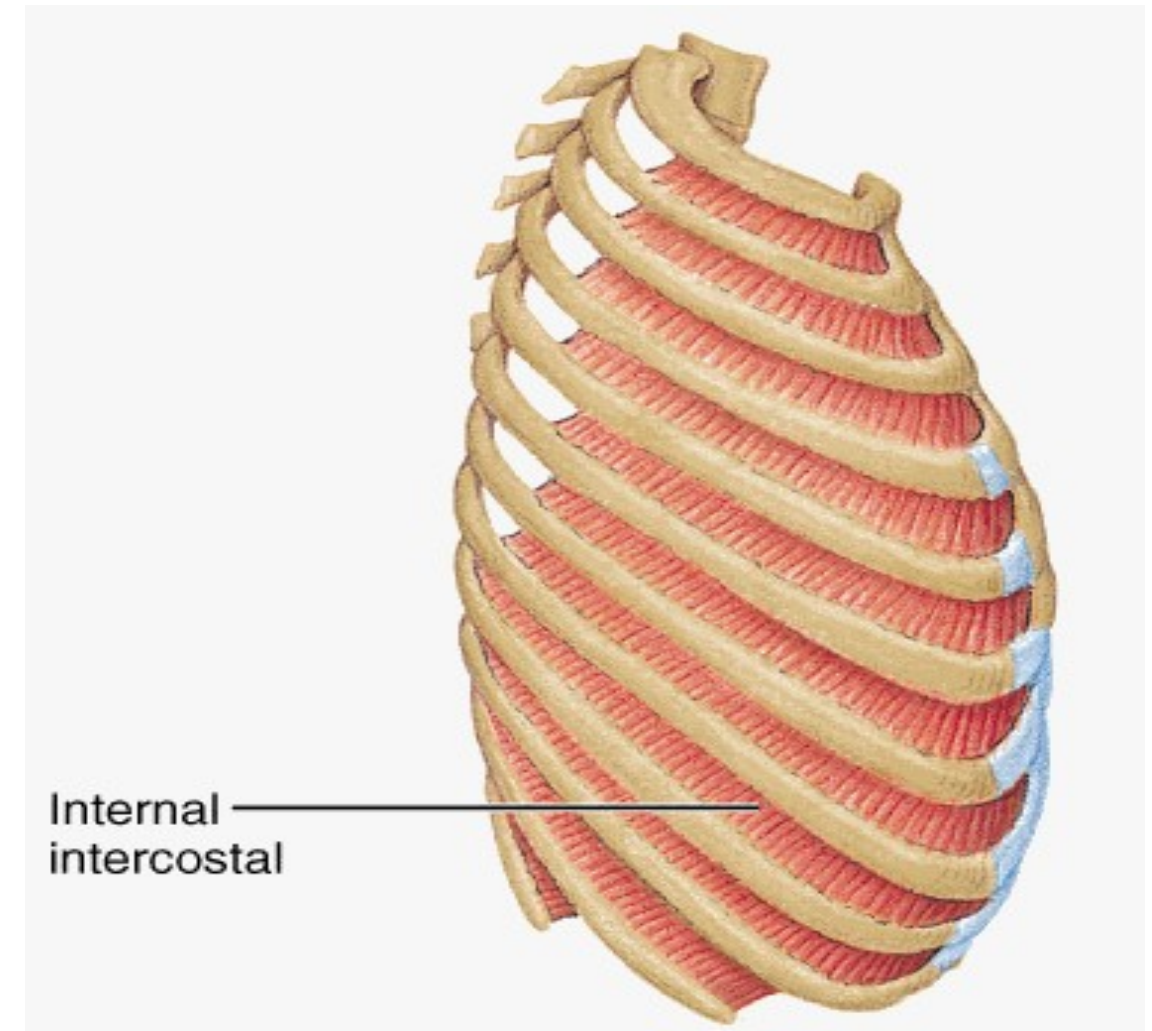
Extent from the tubercle of the rib posteriorly to the junction of rib with its costal cartilage anteriorly where it is



Internal intercostal muscle



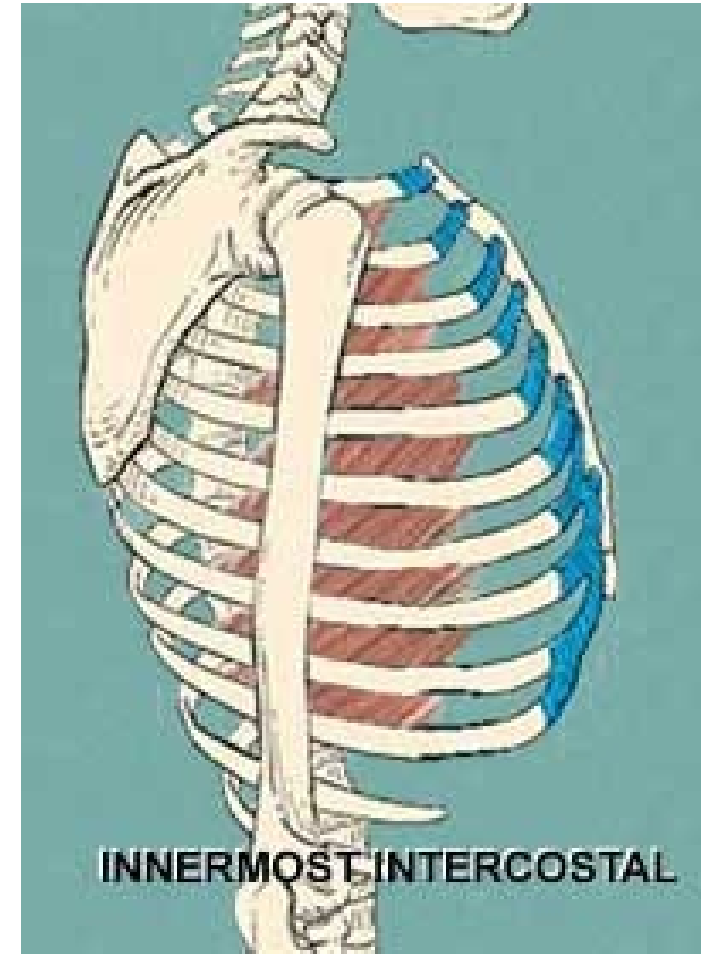
- **Origin:** from the floor of the costal groove of a rib above.
- **Insertion:** Its fibers extend obliquely downwards and backwards to be inserted into the upper border of the rib below.
- **Extent** □ lateral margin of sternum anteriorly to angle of rib posteriorly where it is replaced by the



Innermost intercostal muscle



It is a part of internal intercostal which is split off by the intercostal nerve & vessels

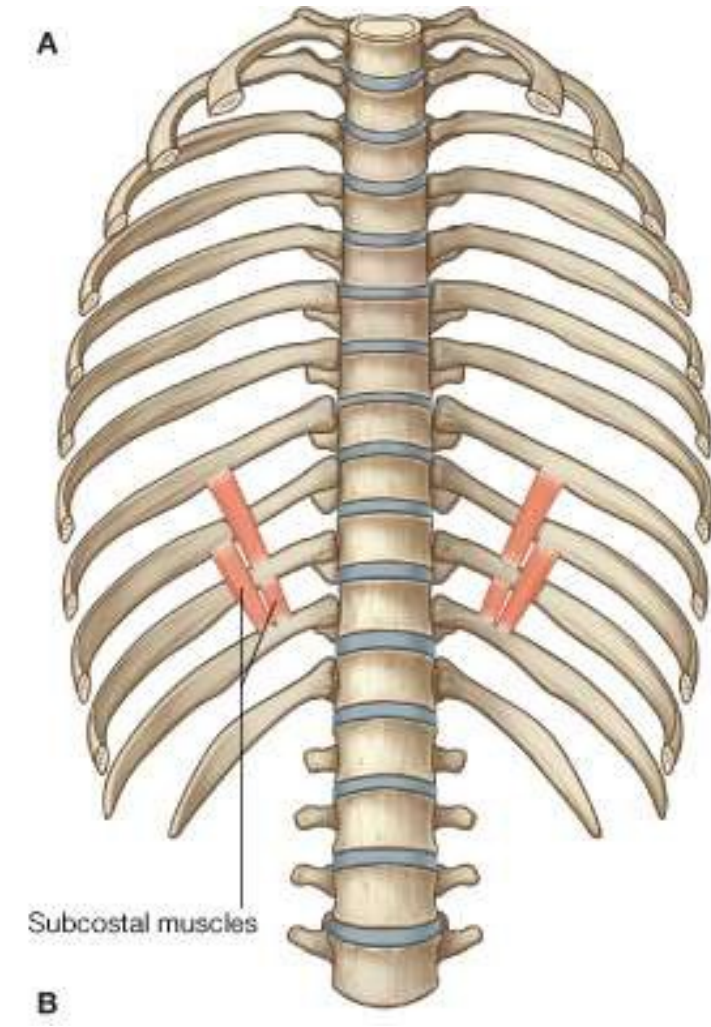


Subcostalis muscle



Thin sheets of muscle fibers on inner aspect of internal intercostal

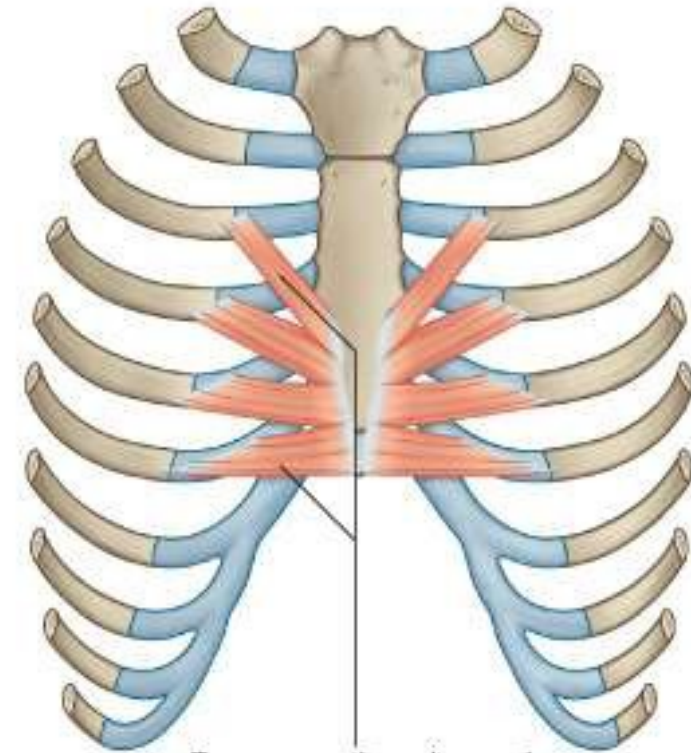
- ☐ **A rises from one rib & crosses 2 or more intercostal spaces to insert in a rib below**
- ☐ **Maybe absent**



Transversus thoracis (Sternocostalis muscle)



Origin □ lower third of back of sternum
Insertion □ slips pass upwards & laterally to insert into 3rd to 6th costal cartilage.



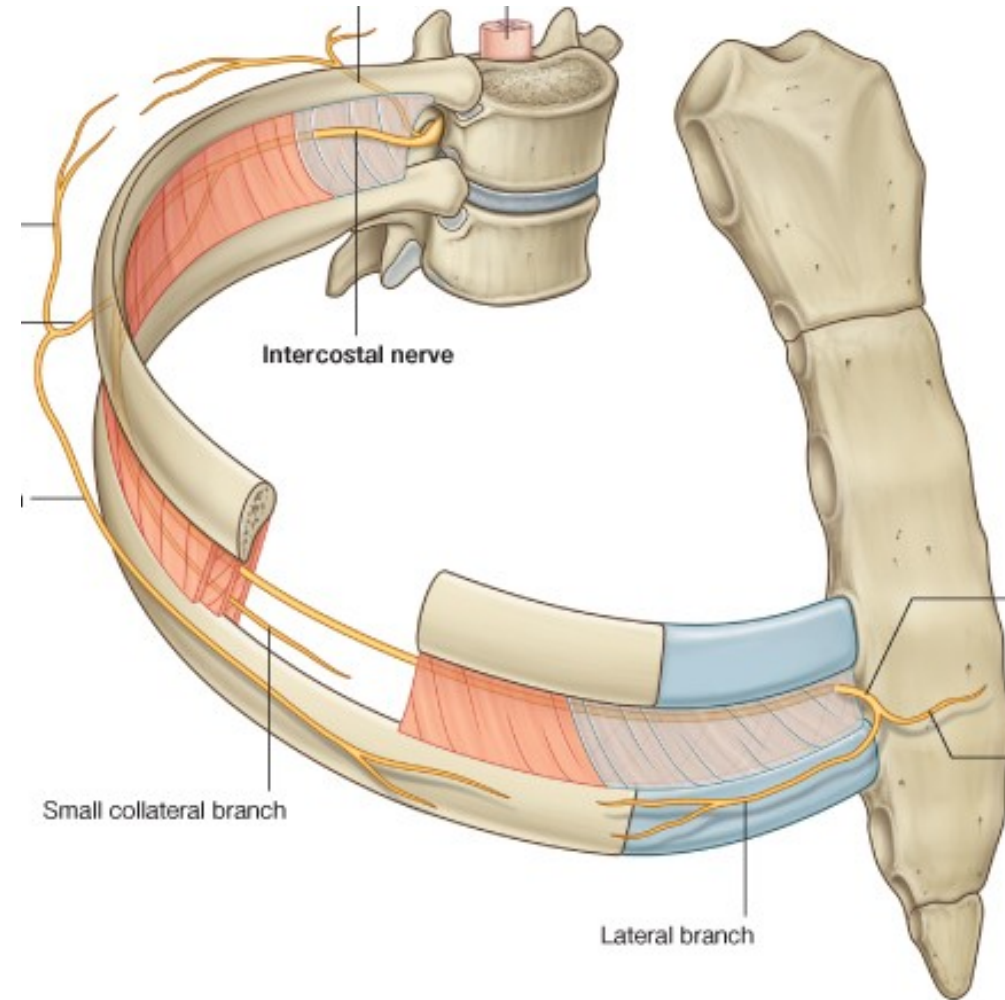
Transversus thoracis muscle

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Intercostal Nerves



- They are **ventral rami** of the 12 pairs of thoracic nerves.
- Last one (number 12) passes below the last rib – so called the **subcostal n**
- They are divided into typical & atypical :
T 3to 6 n have similar course & distribution so are called typical intercostal n
T1,T2 and T7-T11 are atypical nerves

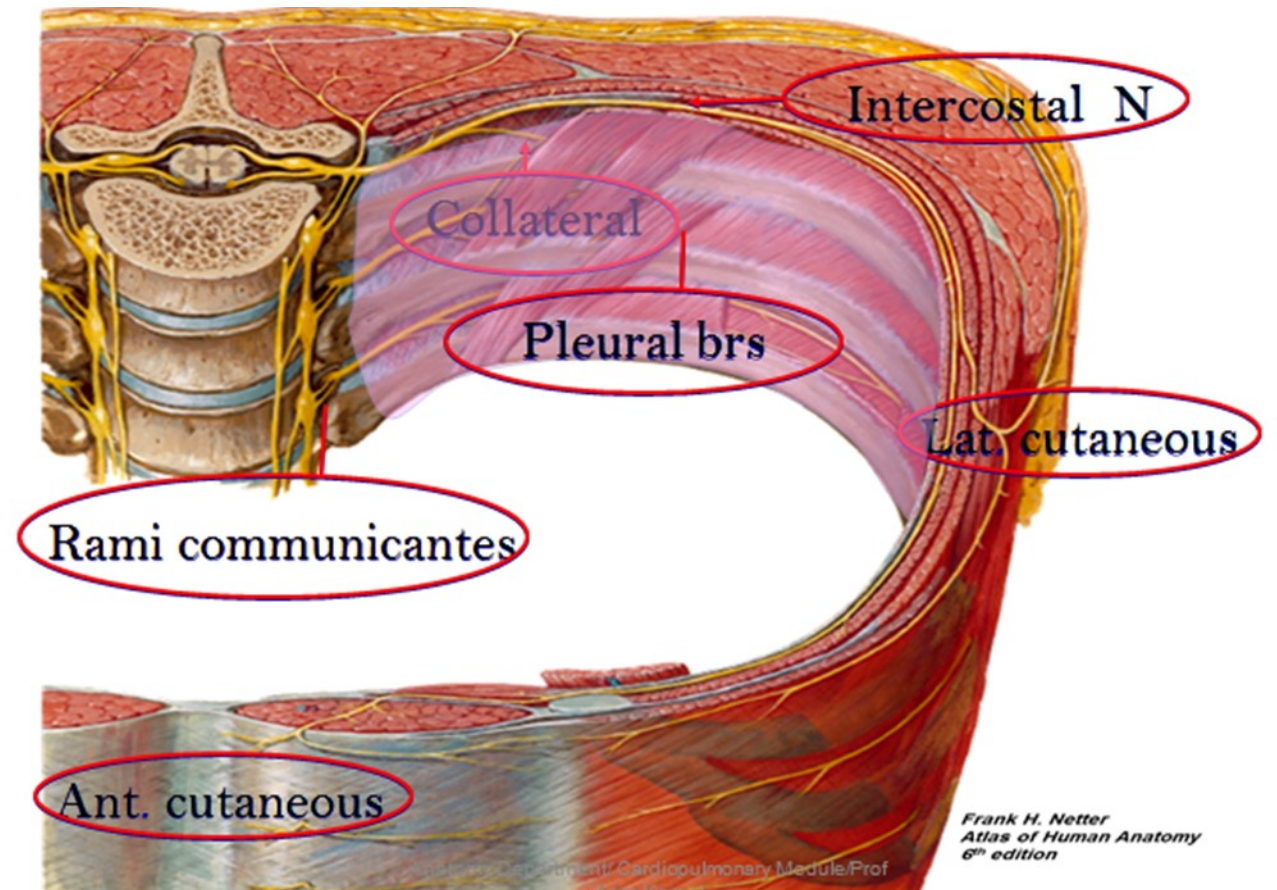


intercostal Nerves



Branches

1. **Rami communicantes** □
to & from sympathetic ganglia
2. **Collateral branch** □
upper border of rib
below
3. **Pleural branches**
□ parietal pleura
4. **Muscular branches** □
intercostal muscles
5. **Lateral cutaneous branch**
6. **Anterior cutaneous branch**



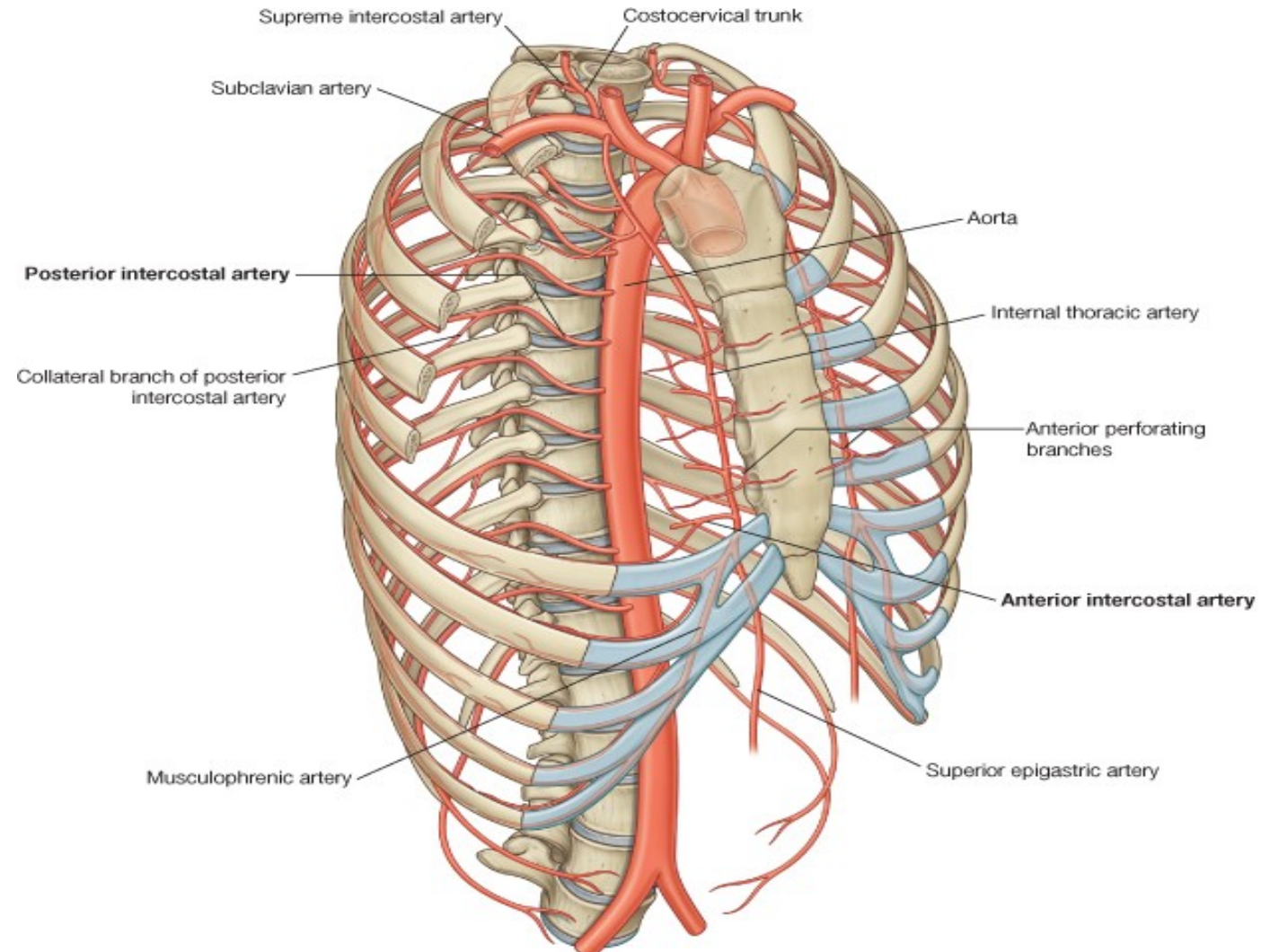
Intercostal Arteries



Anterior intercostal arteries □
2 arteries in each space,
except last 2 spaces which
have no arteries since the last
2 spaces are incomplete
anteriorly.

One artery passes on **lower border of rib above**, the other
on **upper border of rib below**

- Arteries in upper 6 spaces are branches from **internal thoracic artery**
- Arteries in 7th, 8th, 9th spaces are branches from **musculophrenic artery** (one



Intercostal Arteries

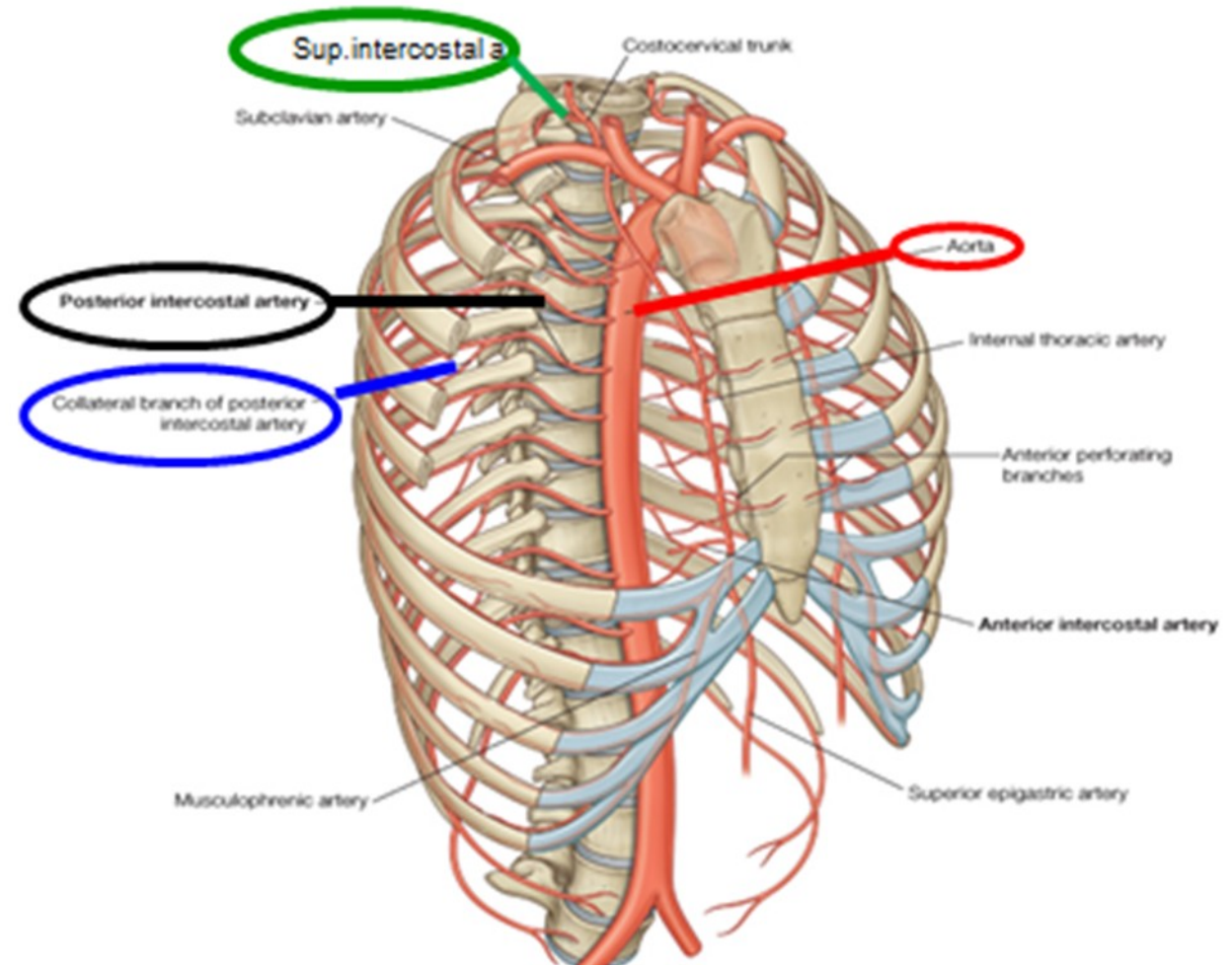


Posterior Intercostal Arteries

- 1 artery in each of the 11 spaces
- Runs on lower border of rib above
- Gives a collateral branch on upper border of rib below

Artery of 1st & 2nd spaces
□ branches of superior intercostal artery

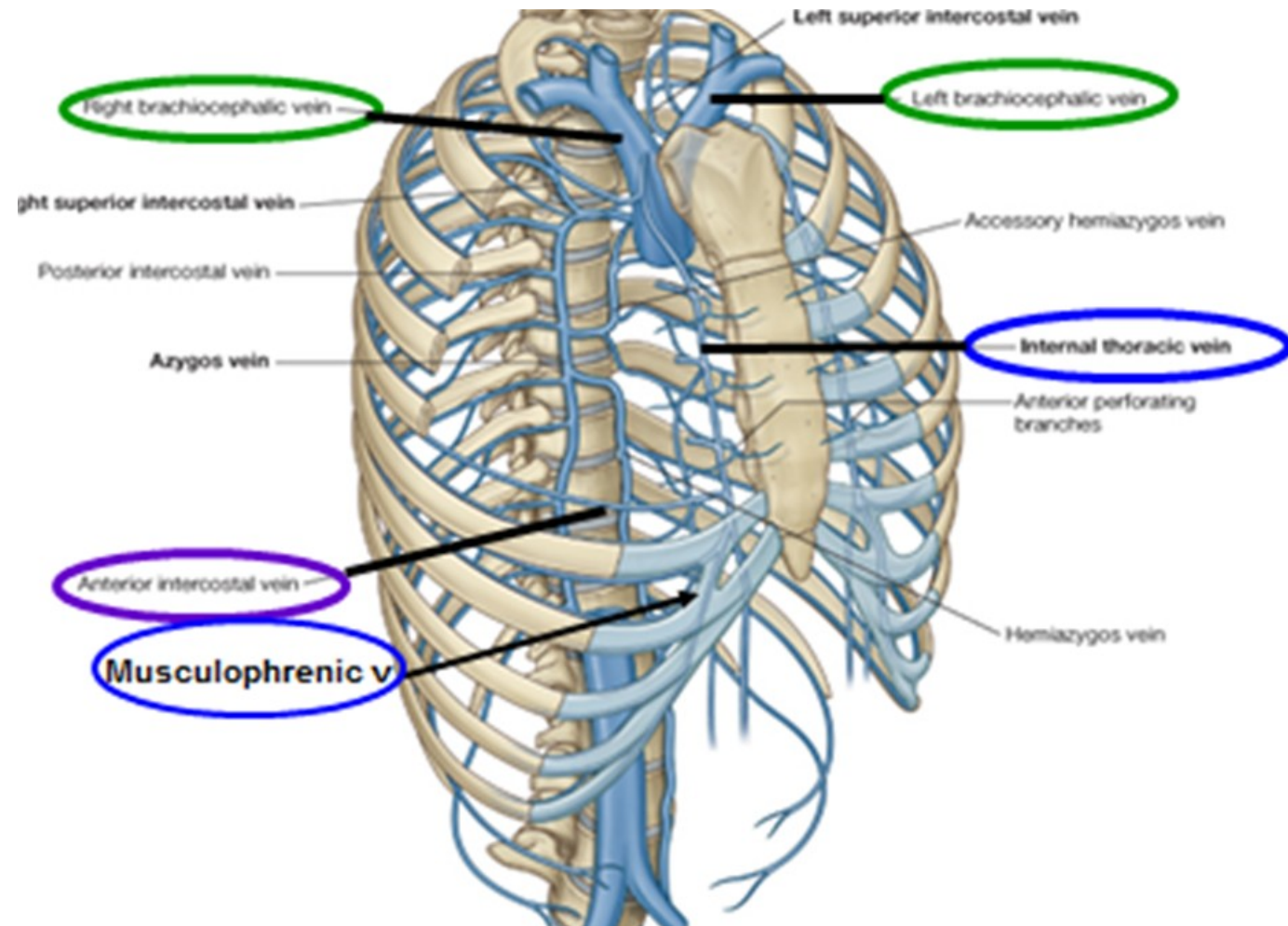
Arteries of 3rd to 11th spaces
□ branches of descending thoracic



Intercostal Veins



- **Anterior intercostal veins** □ follow the arteries.
- **Veins of 7th, 8th & 9th spaces** □ **musculophrenic vein**
- **Veins of upper 6 spaces** □ **internal thoracic vein** □ **innominate (brachiocephalic)**



Intercostal Veins



❑ **Posterior intercostal veins** ❑
11 on each side in the costal groove above their arteries

➤ **Right side**

1st ❑ into right brachiocephalic vein

2nd , 3rd ❑ unite ❑ right superior intercostal arch of azygos vein

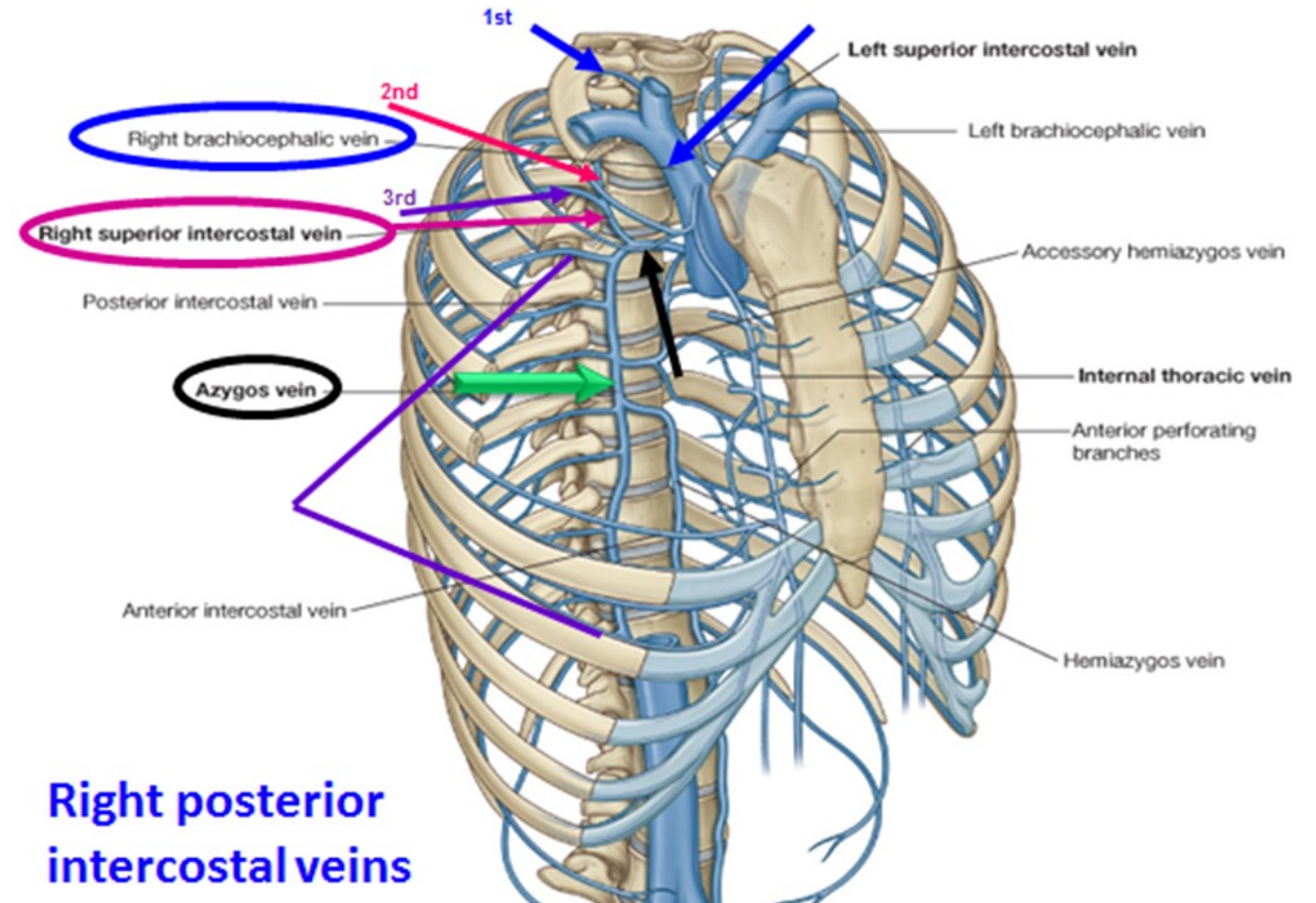
4-11 ❑ into the azygos vein

➤ **Left side**

1st ❑ into the left brachiocephalic vein

2nd , 3rd ❑ unite ❑ left sup. intercostal

❑ left brachiocephalic vein



Right posterior intercostal veins

Diaphragm



Origin:

(sternal - costal - vertebral)

Origin :

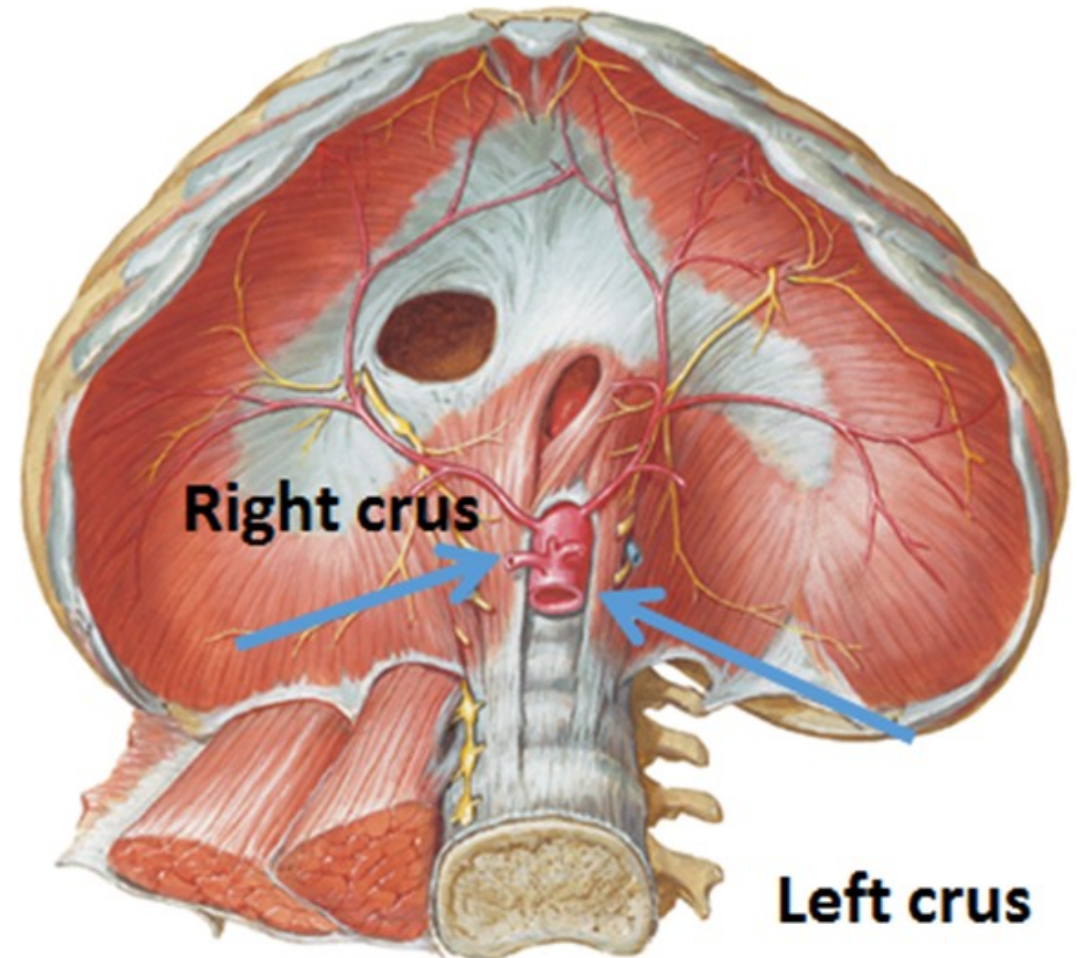
- 1- **Sternal** : back of xiphoid process
- 2- **Costal** : inner surface of lower six ribs & costal cartilage
- 3- **Vertebral** = Two crura & ligaments

Right crus :

- From bodies of upper 3 lumbar Vertebrae.

Left crus :

from upper 2 lumbar

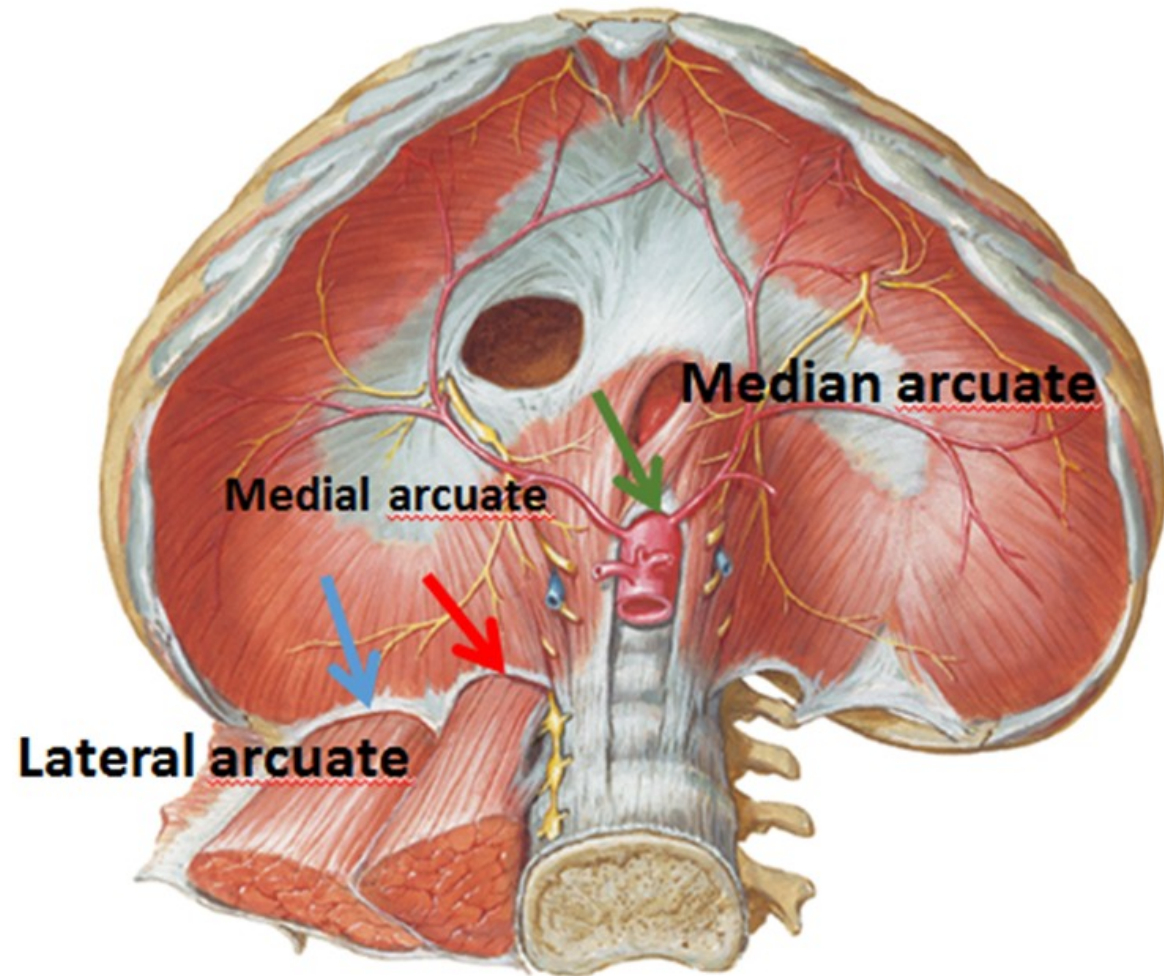


Diaphragm



Origin:

- Median arcuate ligament
: lies across aorta.
➤ between 2 crura.
- Medial arcuate ligament:
 - Extend from side of body of first or second lumbar to front of transverse process of first lumbar.
- Lateral arcuate ligament
 - Extends from front of transverse process of first lumbar to lower border of 12 rib.

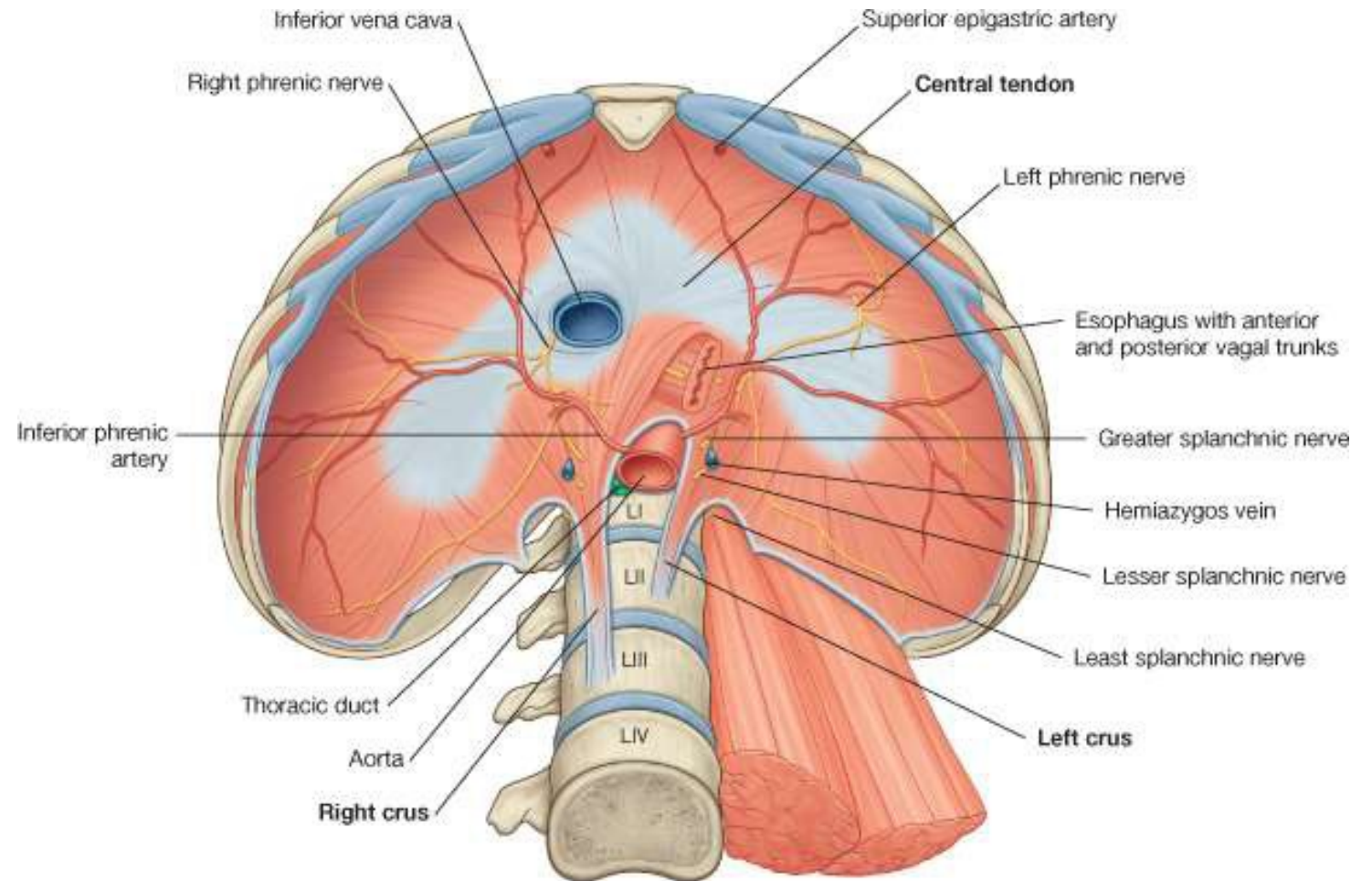


Diaphragm



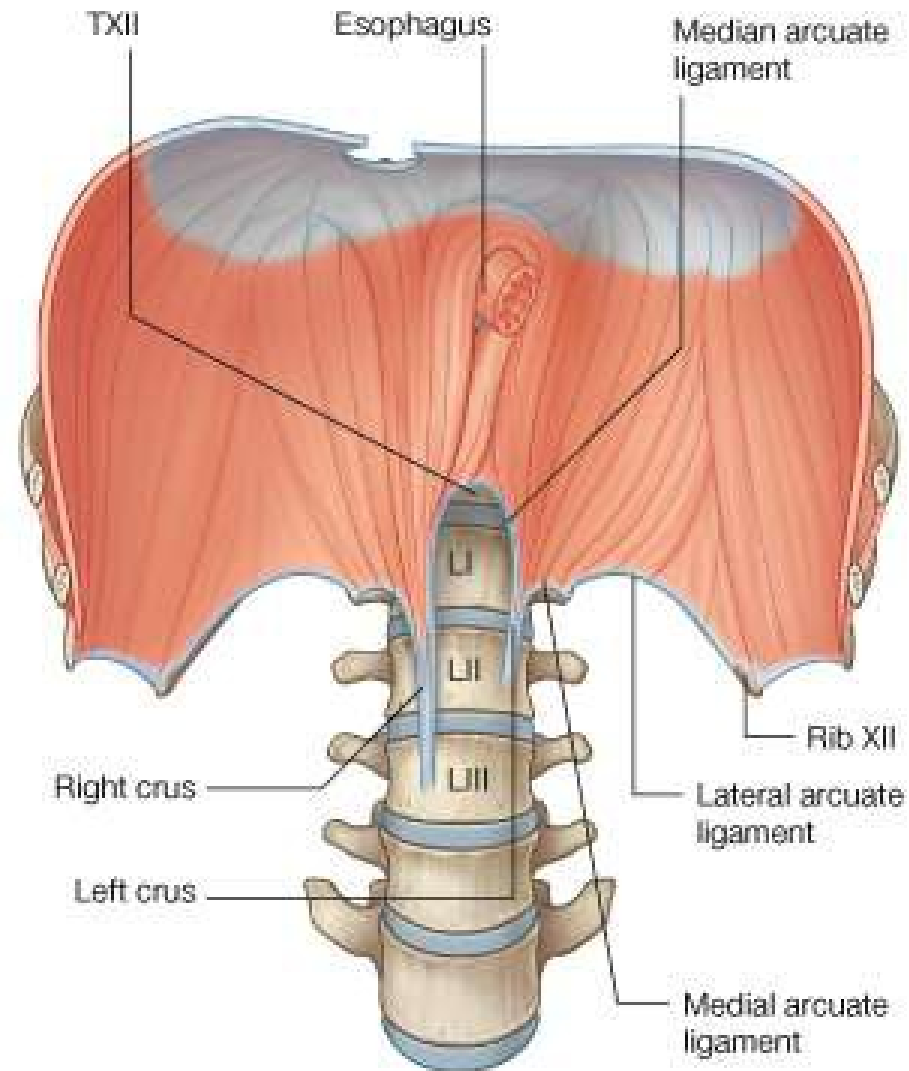
Insertion:
Central tendon

Major Foramina:
Aortic opening T12
Oesophageal opening T10
Vena caval opening T8



Gray's anatomy for students

Diaphragm



Gray's anatomy for students

Anatomy Department

Diaphragm



Army	Of	Voice
Aortic opening	Oesophageal opening	Vena Caval opening
T12	T10	T8
Central	1 inch to the left	1 inch to the Right
<ul style="list-style-type: none"> ➤ Aorta ➤ Thoracic Duct ➤ Azygos vein 	<ul style="list-style-type: none"> ➤ Oesophagus ➤ Lt Vagal trunk ➤ Esophageal Br of left gastric a. 	<ul style="list-style-type: none"> ➤ Rt Phrenic n. ➤ IVC ➤ Lymphatic vs

Diaphragm



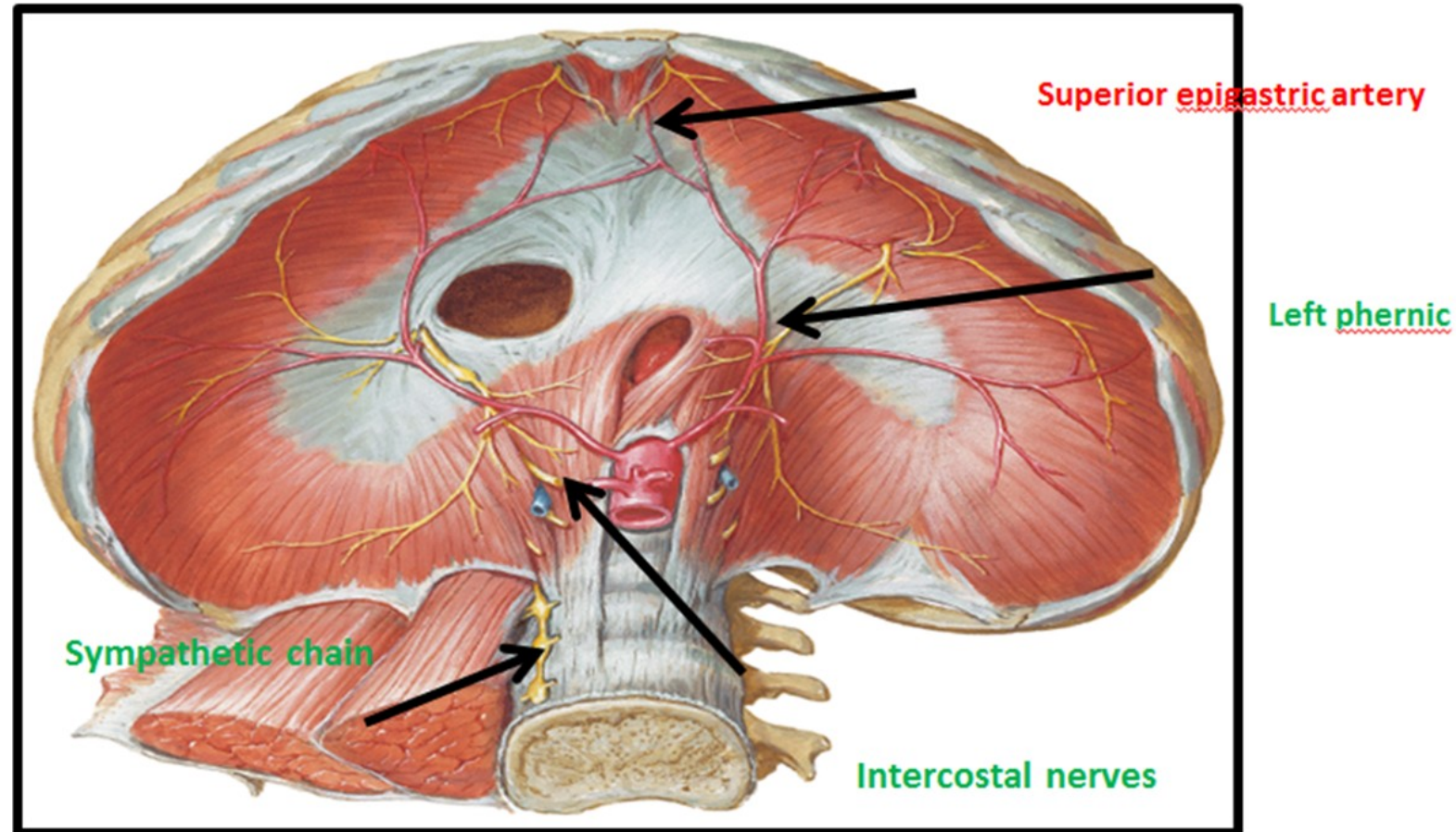
Minor foramina of Diaphragm

□ Arteries

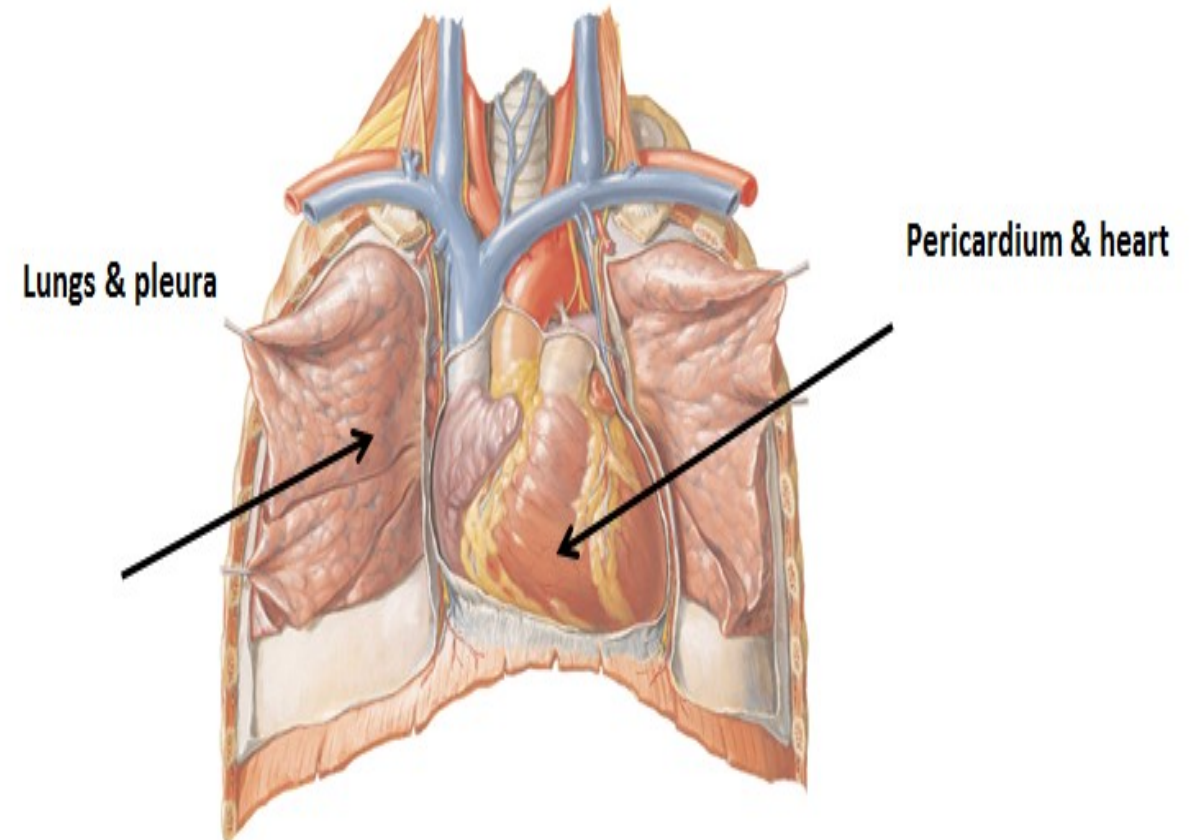
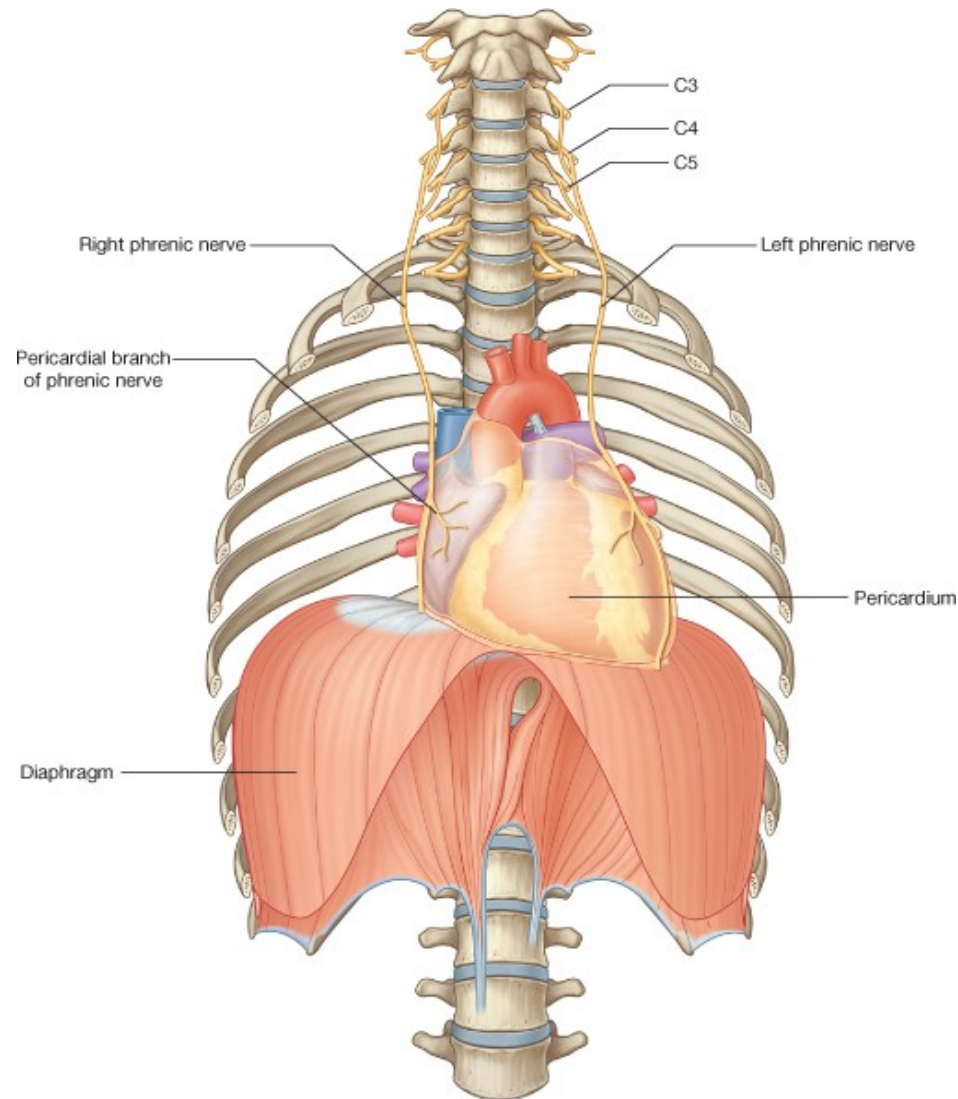
- **Superior epigastric** : between sternal & costal origin
- **Musculophrenic** : pierce diaphragm near 9 costal cartilage

□ Nerves

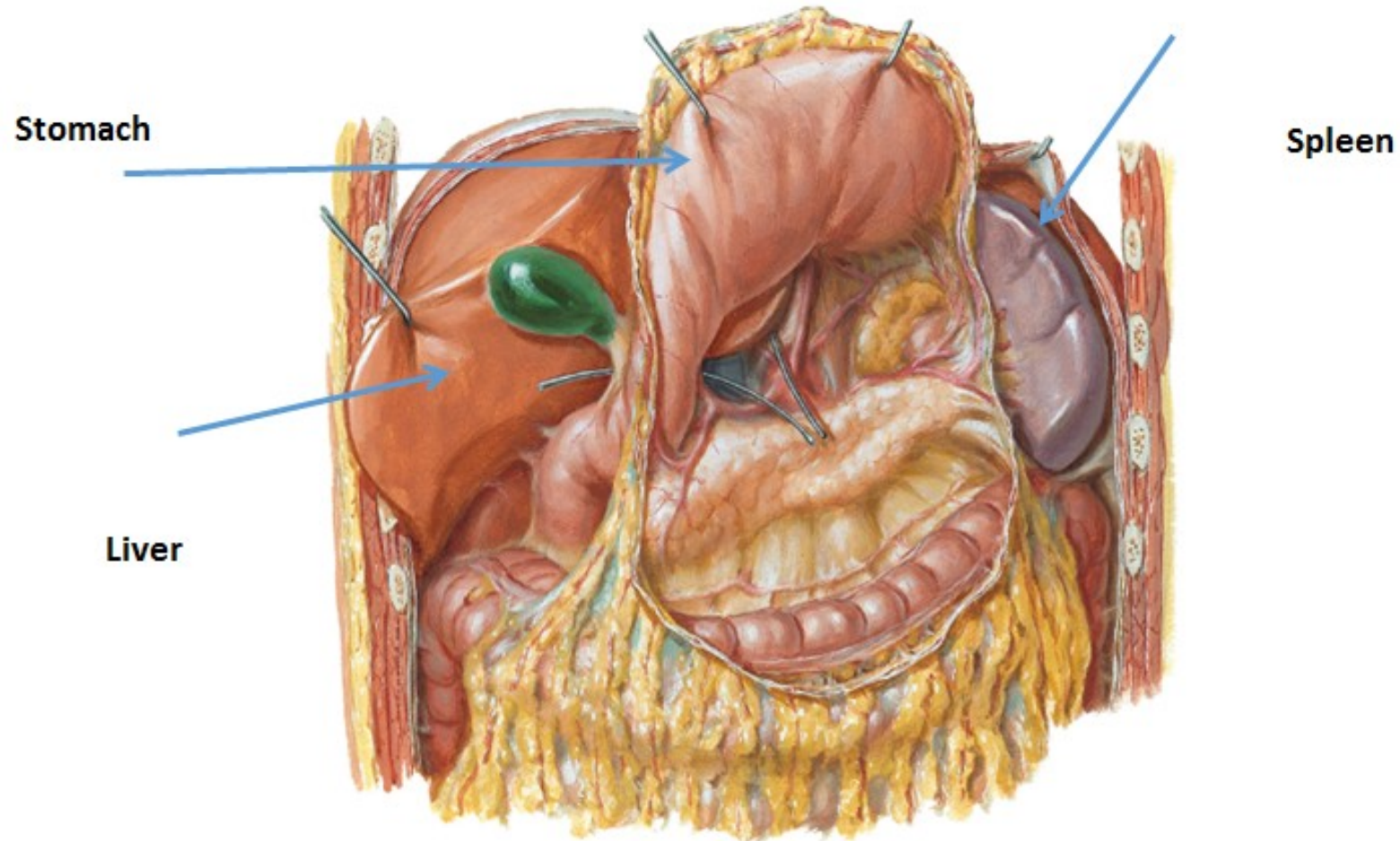
- **Lower five intercostals** : between slips from lower 6 costal cartilage
- **Subcostal nerve & vessel** : behind lateral arcuate
- **Sympathetic chain** : behind medial arcuate
- **Left phrenic** : lateral to



Superior Relation of Diaphragm



Inferior Relation of Diaphragm



Atlas frank netter 2016

Thank you